PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-210673

(43)Date of publication of application : 12.08.1997

(51)Int.Cl. G01C 3/06
H01L 27/146

(21)Application number : 08-014261

(22)Date of filing : 30.01.1996

(71)Applicant : SANYO ELECTRIC CO LTD
SEIKOSHA CO LTD

(72)Inventor : YOSHITOMI TETSUYA
SOMEYA TAKASHI
ITO AKIRA

(54) DETECTING CIRCUIT OF LIGHT RECEIVING POSITION AND DISTANCE DETECTING DEVICE USING IT

(57)Abstract:

PROBLEM TO BE SOLVED: To accurately detect the light receiving position by a simplified structure.

SOLUTION: This circuit is provided with a light receiving part 10 wherein a plurality of photo diodes are arranged in parallel to detect a light and generate a photoelectric current and a resistance group RR wherein each photo diode is correspondingly connected with a plurality of serially connected resistances RR1 to RRn-1 and the photoelectric current from a light generating part 10 is shunted in correspondence with its generation position. First and second current detecting amplifiers 12 and 16 are connected to both ends of the resistance group RR so

as to generate a detecting signal corresponding to the photoelectric currentand a third current detecting amplifier 14 is connected to the midway part of the resistance group RR so as to divide the part 10 into a plurality of light receiving sections and to detect the photoelectric current. The amplifier 14 is switched selectively for its operation by means of a switch 18. When a light is received at the specified position of the part 10 and the photoelectric current is generatedthe resistance group RR shunts the photoelectric current in accordance with its generating positionand respective amplifiers 1214 and 16 detect the obtained photoelectric current and output a detection signal correspondinglythen the light receiving position of the part 10 is detected on the basis of the detection signal.

CLAIMS

[Claim(s)]
[Claim 1]A light sensing portion to which parallel arrangement of two or more optical detector elements which each detects light and generate photoelectric current was carried outA resistance group for being two or more resistance by which the series connection was carried outand said optical detector element being connected corresponding to each resistanceand carrying out the diversion of river of the photoelectric current from said optical detector element according to the occurrence positionA light-receiving position detecting circuit detecting a light-receiving position of said light sensing portion based on a detecting signal which is connected to both ends of said resistance grouprespectivelyand has the 1st and 2nd current detecting means that generate a detecting signal according to photoelectric current supplied via said resistance grouprespectivelyand said current detecting means generates.
[Claim 2]A light-receiving position detecting circuit having the 3rd current detecting means that is connected to resistance of an omitted portion of said resistance groupand divides said light sensing portion further in the light-receiving position detecting circuit according to claim 1 at two or more light-

receiving sections.

[Claim 3]A light-receiving position detecting circuitwherein said 3rd current detecting means divides said light sensing portion in the light-receiving position detecting circuit according to claim 2 at two or more light-receiving sections of unequal length.

[Claim 4]A light-receiving position detecting circuit having further a switch which changes arbitrarily detecting operation of said 3rd current detecting meansor its operation stop in a light-receiving position detecting circuit given in one side of claim 2 or 3.

[Claim 5]A light-receiving position detecting circuitwherein each resistance of said resistance group is constituted by diffused resistor of an impurity formed in a semiconductor substrate in a light-receiving position detecting circuit of any one statement of claim 1-4.

[Claim 6]A light-receiving position detection method characterized by comprising the following using the light-receiving position detecting circuit according to claim 4.

A process of judging a light-receiving field in said light sensing portion based on a detecting signal from said 1st and 2nd current detecting means by making said 3rd current detecting means into an operation stopped state with said switch.

The 3rd current detecting means located in both ends of said light-receiving section which divides said light sensing portion by making said 3rd current detecting means into an operating state at two or more light-receiving sectionsand when said light-receiving field belongs with said switchA process of searching for a light-receiving position of said light sensing portion based on a detecting signal acquiredrespectively from either of said 1st or 2nd current detecting means.

[Claim 7]A light-emitting part which is a distance sensing device using a light-receiving position detecting circuit of any one statement of claim 1 - claim 5is further arranged by said light sensing portion and a predetermined optical

position relationand emits light towards an objectA condensing means which condenses light which returns from said light-emitting part through an objectand is led to said light sensing portionA distance sensing device having the operation part which performs a distance operation from said light-emitting part to said objectand detecting distance from said light-emitting part to said object from a predetermined reference position on said light sensing portion using distance to a light-receiving positionand optical distance of said light-emitting part and said condensing means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention is a circuit which detects the light-receiving position in a light sensing portion.

For exampleit is related with the light-receiving position detecting circuit used for the distance sensing device for autofocus [of a camera].

[0002]

[Description of the Prior Art]Conventionallyin the distance sensing device used for the automatic focusing function of a cameraetc.PSD (Position Sensitive light Detector) which is discrete part is used.

[0003]Drawing 7 shows the outline composition of some distance sensing devices which used this PSD50. PSD50 is a semiconductor device which changes into photoelectric current the light which received light using the pn junction formed in the semiconductor substrate.

The electrode for photoelectric current extraction which is not illustrated is formed in the both ends of PSD50.

The internal resistance which has the predetermined resistance which comprised

p layer or the n layer of the semiconductor exists in inter-electrode [this].
The photoelectric current generated in PSD50 is shunted by internal resistance according to the occurrence positionand is taken out from the electrode of both ends.
The photoelectric current taken out from each electrode is in inverse proportion to the distance from the occurrence position to each electrode.
The amplifier 52 and 54 by which the input terminal was connected to each electrode measures the photoelectric current and the reference voltage Vref which were taken out from each electrodeand generates a predetermined detecting signal.
The output terminal of the amplifier 52 and 54 is connected to each input terminal of the amplifier 56respectively.
The amplifier 56 compares the output signal from the amplifier 52 and 54and generates a predetermined detecting signaland the operation part which is not illustrated searches for the light-receiving position in PSD50 based on this detecting signal.

[0004]For examplein distance sensing devicessuch as a cameraobjectssuch as a photographic subjectare irradiated from the light-emitting part which is not illustratedthe position in which the catoptric light from an object entered into PSD50 is detectedand the distance from a camera to an object is found based on this light-receiving position. The lens position of a camera is moved according to the detected distanceand focus doubling of the camera is performed.
[0005]
[Problem(s) to be Solved by the Invention]Howeversince the photoelectric current generated by light-receiving in PSD50 is very small (for examplenA grade) very muchthere is a problem of being easy to be influenced by an extraneous noise. Since PSD50 was especially constituted as discrete parta possibility of being superimposed on an extraneous noise by the wiring route from the both ends of PSD50 to the amplifier 52 and 54 was high. In order to reduce the influence of

such a noisehow to enlarge the gain of the amplifier 52 and 54 is also consideredbut nowa noise level cannot rise with increase of a gaineither and a S/N ratio cannot be improved.

[0006]Although the IC form of PSD50 and each amplifier 52 and 54 is carried outfor example and how to shorten a wiring route is also consideredIn this casemanufacture of the internal resistance of PSD50 could not receive restrictions of other semiconductor device manufacturing processes (especially impurity concentration)such as a transistorcould not form easily the internal resistance which has arbitrary resistance required to detect very small photoelectric currentand was not realistic.

[0007]Thenbyshortening the wiring route length of the amplifier 52 and 54 if possible from PSD50 from before in the light-receiving position detecting circuit using PSD50and shielding this wiring separatelyinfluence of a noise was lessened and required light-receiving position detection accuracy was maintained. For this reasonthe flexibility of the device design was restricted and there were problemslike assembly cost etc. are high.

[0008]In order to improve the accuracy of distance detection distanceequalizing processing was performed to the distance to the light-receiving position acquired by repeating light-receiving detecting position operation many timesor the object for which it asked. For this reasonthere was a problem that distance detection took a long time.

[0009]In order to solve an aforementioned problemthe light-receiving position detecting circuit and distance sensing device of this invention prevent the influence of an extraneous noiseand aim at providing the light-receiving position detecting circuit and distance sensing device which make it possible to detect a light-receiving position or distance with sufficient accuracy for a short time.

[0010]

[Means for Solving the Problem]To achieve the above objectsa light-receiving position detecting circuit of this invention has the following features.

[0011]Firsta light sensing portion to which parallel arrangement of two or more

optical detector elements which each detects light and generate photoelectric current was carried outA resistance group for being two or more resistance by which the series connection was carried outand said optical detector element being connected corresponding to each resistanceand carrying out the diversion of river of the photoelectric current from said optical detector element according to the occurrence positionIt is connected to both ends of said resistance grouprespectivelyand has the 1st and 2nd current detecting means that generate a detecting signal according to photoelectric current supplied via said resistance grouprespectivelyand a light-receiving position of said light sensing portion is detected based on a current detecting signal which said current detecting means generates.

[0012]Thusin this inventionphotoelectric current which two or more optical detector elements by which parallel arrangement was carried out receiveand is generated is shunted by resistance group provided separately according to the occurrence position. Each resistance of series-connection resistance which constitutes this resistance group is not restrained by manufacturing process in particular of an optical detector elementbut can be set as any value. Thereforeit becomes possible to form each composition of a light-receiving position detecting circuit in the same substrateand to one-chip-ize it. for this reasonit becomes easy to be able to shorten extremely wiring distance from a light sensing portion to a current detecting meansand to shield this wiring route electricallyit is markedly alikedetecting accuracyi.e.light-receiving position detection accuracyof photoelectric currentand it rises.

[0013]In this inventionwe connected the 3rd current detecting means to resistance of an omitted portion of said resistance groupand decided to divide a light sensing portion by this 3rd current detecting means at two or more light-receiving sections.

[0014]When making it the length of the light-receiving section divided by this 3rd current detecting means become unevenlight-receiving position detection accuracy in the short light-receiving section of length can be selectively made

high to other sections.

[0015]In this inventiondetecting operation of this 3rd current detecting means or its operation stop is further characterized by an arbitrarily switchable thing with a switch. Thusdivision into the light-receiving section of a light sensing portion is selectively performed by switch by changing operation of the 3rd current detecting means.

[0016]Each resistance of said resistance group is characterized by being a diffused resistor of an impurity formed in a semiconductor substrate. For this reasonit becomes easy to be between each resistanceand for there to be no dispersion in a ratio of that resistanceand to set up that resistance arbitrarily.

[0017]Nextif it is in a light-receiving position detection method using the above-mentioned light-receiving position detecting circuit of this inventionbased on a detecting signal from said 1st and 2nd current detecting meansa light-receiving field in said light sensing portion is first judged by making said 3rd current detecting means into an operation stopped state with said switch. Nextsaid 3rd current detecting means is made into an operating state with said switchSaid light sensing portion is divided at two or more light-receiving sectionsand said light-receiving position is searched for from said the 1st or 2nd either 3rd current detecting means located in both ends of the light-receiving section when said light-receiving field belongs or current detecting means based on a detecting signal acquiredrespectively.

[0018]If it is in a distance sensing device using the above-mentioned light-receiving position detecting circuitA light-emitting part which is arranged by said light sensing portion and a predetermined optical position relationand emits light towards an objectA condensing means which condenses light which returns from said light-emitting part through an objectand is led to said light sensing portionIt has the operation part which performs a distance operation from said light-emitting part to said objectand distance to said target position is detected from said light-emitting part using distance of a predetermined reference position on said light sensing portionand a light-receiving positionand optical distance of said

light-emitting part and said condensing means. Since the reliability of detected distance will become high and detection of a light-receiving position will be performed for a short time if distance to an object is found using a very high light-receiving position detecting circuit of position detection accuracydistance detection time is shortened substantially.

[0019]

[Embodiment of the Invention]Hereafterthe embodiment of this invention is described using a drawing. In the drawing explained belowidentical codes are given to a mutually corresponding portion.

[0020][Composition of a light-receiving position detecting circuit] Drawing 1 shows the composition of the light-receiving position detecting circuit concerning the embodiment of this invention. In the figurethe light sensing portion 10 carries out parallel arrangement of two or more rectangular photo-diode (PD)10-1 - 10-n with a prescribed intervaland is constituted. When replacing with PSD and using this light sensing portion 10the total acceptance surface product of the light sensing portion 10 which comprises two or more photo-diodes 10-1 - 10-n is set up to the same extent as the acceptance surface product of PSD.

[0021]The resistance group RR is constituted by two or more resistance RR1 by which the series connection was carried out - RRn-1and the photo-diode 10-1 - 10-n correspond to each resistance RR1 - RRn-1and it is connected to them.

[0022]One input terminal of the 1st and 2nd current detection amplifier 12 and 16 is corresponded and connected to the both ends of the resistance group RR. This amplifier 12 and 16 is a current voltage conversion circuit which changes the very small photoelectric current from the light sensing portion 10 into a voltage signaland detects photoelectric current. One input terminal of the 3rd current detection amplifier 14 is connected to predetermined resistance located in the omitted portion of the resistance group RR. Divide the resistance group RR into divisionand it divides the light sensing portion 10 among the two or more division at two or more light-receiving sectionsand this 3rd current detection amplifier 14 has changed into the voltage signal the photoelectric current generated in each

light-receiving section like other amplifier 12 and 16. The switch 18 which comprises the NPN type transistor Q1for example is connected to the 3rd current detection amplifier 14.

[0023]Corresponding to a control signal predetermined from control sectionssuch as a microcomputer of the after-mentioned [the switch 18 / switch terminal / TSW]selectivelyone input terminal and resistance group RR of the 3rd current detection amplifier 14 are connected and interceptedandtherebycurrent detection operation of the 3rd current detection amplifier 14 is controlled in them.

[0024]Between one input terminal of each amplifier 1214and 16and the output terminals VOUT1-VOUT3resistance and a capacitor are connected in parallelrespectivelyand the common reference supply (Vref) is connected to the input terminal of another side of each amplifier 1214and 16 between. Each amplifier 1214and 16 is formed between a common power supply (VCC) and ground (GND)and is operating.

[0025]Hereif two or more photo-diodes 10-1 - either of the 10-n receive light and photoelectric current is generatedthe photoelectric current generated according to the occurrence position will be shunted by the above-mentioned resistance group RR. If the photoelectric current from the light sensing portion 10 is supplied to the input terminal of one of theseeach current detection amplifier 1214and 16The reference voltage Vref supplied to the input terminal of another side of this and each amplifier 1214and 16 is measuredthe predetermined detecting signal according to photoelectric current is generatedand this is outputted from each output terminals VOUT1-VOUT3.

[0026]Drawing 2 shows the section outline of the light-receiving position detecting circuit of drawing 1. As shown in drawing 2both the light sensing portion 10 which constitutes a light-receiving position detecting circuitand the resistance group RR and the current detection amplifier 12 and 14 and the circuit part 20 that comprises 16 grades are formed in the same semiconductor substrate 22.

[0027]Each photo-diode 10-1 - 10-n are constituted by the pn junction in a

semiconductor substrateandon the other handthe resistance group RR is constituted by the diffused resistor etc. of the impurity formed in the same board. The resistance of each resistance RR one to n-1 of the resistance group RR can be arbitrarily set up by changing the area of the diffused resistor in a semiconductor substrate. Each resistance RR one to n-1 is the same processand since it is formed in the same area part of a substratedispersion in the resistance in each resistance one to n-1 is stopped very small.

[0028]The SiO2 layer 21 is formed the whole surface on the substrate 22and it is this SiO2. The opening 27 is formed on the field of the light sensing portion 10 of the layer 21and the metallic wiring layers 23 and 24 of the circuit part 20 are separated and formed by the layer insulation layer in the meantime on the field of one circuit part 20. The light shielding layer 26 is formed in the upper layer of the wiring layer 24 so that the formation area of the circuit part 20 may be covered via a layer insulation layerthe formation area of the circuit part 20 is shaded by this light shielding layer 26and the light from the outside is irradiated by only the light sensing portion 10 by it. This light shielding layer 26 is formed with the metallic materialand it is connected to a power supply (VCC) or a ground (GND)and it is functioning also as a shield layer of an extraneous noise. On the light shielding layer 26the jacket layer 25 is further formed as a protective layer.

[0029][Composition of a distance sensing device] Drawing 3 shows the example of composition of the camera which used for the distance sensing device the photodetection circuit shown in drawing 1. The light-emitting part 31 which generates infrared lightand the light sensing portion 10 make a part of auto-focusing (AF) part 30and this light-emitting part 31 and light sensing portion 10 of each other are arranged by the predetermined optical position relation so that it may be reflected with the photographic subject 40 and the infrared light from the light-emitting part 31 may enter into the light sensing portion 10.

[0030]If the light from the light-emitting part 31 enters into the prescribed position of the light sensing portion 10the photoelectric current from the photo-diode which received light will be shunted by the resistance group RR according to the

positionand will be detected with the current detection amplifier 1214and 16. The current detection amplifier 1214and 16 outputs the microcomputer 34 for the detecting signal based on the photoelectric current from the light sensing portion 10. And based on the detection result which was obtained from this current detection amplifier 1214and 16 as for the microcomputer 34The position of the photo-diode 10-1 whichnamelyreceived light - 10-n is judgedand the distance from a camera to the photographic subject 40 is calculated using the method of mentioning later based on the position. [the photo-diode] [light-receiving] According to the found distancea predetermined driving signal is supplied to Motor Driver 36.

[0031]Motor Driver 36 drives the motor 38 for lenses according to this driving signalthe position of a lens is changed by thisand the focus of a camera is adjusted according to the distance of a camera and a photographic subject. As for the memory 32 in a figurethe arithmetic contents in the microcomputer 34its resultetc. are memorized.

[0032][Light-receiving position detection method] An example of the detecting method of the light-receiving position in the light sensing portion 10 in this embodiment is further explained below using **4**. Drawing 4 shows the relation between the photoelectric current detected with the current detection amplifier 1216and 14 of drawing 1and the light-receiving position in the light sensing portion 10.

[0033]When the 3rd current detection amplifier 14 is not used but the amplifier 12 and 16 detects photoelectric currentthe photoelectric current detected with each amplifier 12 and 16 as shown in drawing 4 (b)It becomes so small that the light-receiving position of the light sensing portion 10 in inverse proportion or separates from each amplifier 12 and 16 in inverse proportion to the distance of each amplifier 12 and 16 and a light-receiving position. For examplewhen the light-receiving position in the light sensing portion 10 is [beta] in a figureonly the part whose distance of the photoelectric current detected with the amplifier 16 is nearer than the photoelectric current detected with the amplifier 12 becomes

large.

[0034]Thereforethe microcomputer 34 of a light-receiving position calculation partfor exampledrawing 3can search for the light-receiving position in the light sensing portion 10 based on this detecting signalif the detecting signal according to photoelectric current is supplied from the amplifier 12 and 16.

[0035]According to this embodimentin order to raise the detecting accuracy of a light-receiving position furtheras already explainedthe 3rd current detection amplifier 14 is connected to the omitted portion of the resistance group RR of drawing 1. As shown in drawing 4 (a)when this amplifier 14 is connected to resistance of the center section of the resistance group RR by control of the switch 18 of drawing 1The photoelectric current which the resistance group 10i.e.a corresponding light sensing portionis divided by the central amplifier 14 at the two sections A and Band is detected with each amplifier 1214and 16 becomes like drawing 4 (c). In drawing 4 (c)the photoelectric current from which a dotted line is detected with the amplifier 14the photoelectric current from which a solid line is detected with the amplifier 12and a dashed dotted line show the photoelectric current detected with the amplifier 16. And as shown in drawing 4 (c)the photoelectric current which the amplifier 12 and 14 generates in the section A is detectedand the photoelectric current which the amplifier 14 and 16 generates in the section B is detected. Thusif two or more amplifier 14i.e.the 3rd current detection amplifieris formed and a light-receiving field is divided at two or more sectionsfor examplewhen the length of the sections A and B is almost equalThe section length whom each amplifier 12 and 16 detects will become abbreviation halfand the detecting accuracy in each amplifier 12 and 16 to change of the light-receiving position in the light sensing portion 10 will be about 2 times as compared with the case of drawing 4 (b). Thereforeit becomes possible to make light-receiving detecting accuracy higher.

[0036]Drawing 4 (d) shows other examples of arrangement of the 3rd current detection amplifier 14. The light sensing portion 10 is divided into unequal light-receiving section A' of lengthand B' by the amplifier 14 in drawing 4 (d). The

inside of B' and the short section (a figure B') have the photoelectric current detecting accuracy of amplifier higher than the section of another sideas shown in drawing 4 (e)and they are high. [of this light-receiving section A' and the position detection accuracy in this section] Thereforewhen there is a field where higher position detection accuracy is demanded in the light sensing portion 10a demand of detecting accuracy can be satisfied by making the field into the shorter section.

[0037]For exampleit is required that the accuracy of focus doubling to the photographic subject 40 which exists at a short distance should be higher than focus doubling to the photographic subject 40 in a camera which is in a long distance if autofocus. And the light obtained from the photographic subject 40 located in the short distance of a camera so that it may mention later enters within the predetermined section of the light sensing portion 10. Thenthe amplifier 14 is arranged so that the section length of the field into which the light from the photographic subject 40 of a short distance enters may become short. If it does in this waythe light-receiving position of the light from the photographic subject 40 of a short distance will be detected within the narrow section of an intervaland can make detecting position sensitivity high especially by the short distance side.

[0038]If zoom-ization of a camera progresses and the taking lens of high magnification is usedthe accuracy of focus doubling will be required also from the photographic subject 40 in a long distance. In proportion to 1 for the square of distanceas for the catoptric light current from the photographic subject 40 in a long distancelight-receiving photoelectric current becomes small. Thereforeit is necessary to make high light-receiving detecting accuracy over the photographic subject 40 in a long distance. And the light obtained from the photographic subject 40 located in the long distance of a camera so that it may mention later enters within the predetermined section of the light sensing portion 10. Thenthe amplifier 14 is arranged so that the section length of the field into which the light from the long-distance photographic subject 40 enters may become short. If it

does in this waythe light-receiving position of the light from the long-distance photographic subject 40 will be detected within the narrow section of an intervaland can make detecting position sensitivity high by the long distance side.

[0039]Although drawing 4 shows the example which provided one of the amplifier 14 as the 3rd current detection amplifierthe 3rd current detection amplifier is not restricted to onebut may be formed in it based on the position detection accuracy demanded. [two or more]

[0040]Nextas shown in drawing 4the light-receiving detecting position procedure using the 1st2ndand 3rd current detection amplifier 1216and 14 is further explained using drawing 5.

[0041]Firstbased on the control signal from the microcomputer 34 of drawing 3the light-emitting part 31 generates the infrared light IRED in pulse form (refer to drawing 5 (a)). The light sensing portion 10 receives the light which the light from this light-emitting part 31 is reflected with the photographic subject 40and returns. At this timeas shown in drawing 5 (b)the control signal of "L level" from the microcomputer 34 is supplied to that basefor exampleOFF control of the transistor Q1 which is the switch 18 is carried outand the 3rd current detection amplifier 14 will be separated from the resistance group RRand will be in an operation stopped state. For this reasonthere is no output from the amplifier 14 (refer to drawing 5 (e))and it detects in the characteristic that the photoelectric current which the 1st and 2nd current detection amplifier 12 and 16 of the both ends of the resistance group RR generated is shown in drawing 4 (b).

[0042]Supposing the light-receiving position in the light sensing portion 10 is [beta] of drawing 4 (a)for examplethe way of the photoelectric current detected with the amplifier 16 as shown in drawing 5 (c) and (d) will become larger than the photoelectric current detected with the amplifier 12. Thereforethe detect output of the amplifier 16 becomes larger than the detect output of the amplifier 12. The microcomputer 34 measures this detect outputthe light-receiving position in the light sensing portion 10 is amplifier 16 slippagei.e.it is judged that a light-receiving field exists in the section B.

[0043]Nextas shown in drawing 5 (b)the microcomputer 34 is predetermined timingsupplies the control signal of "H level" to the switch 18for exampleand carries out switch control of the switch 18 from the 1st infrared light IRED generating in the light-emitting part 31 before the 2nd infrared light IRED generating. thereby -- amplifier -- 14 -- a resistance group -- RR -- connecting -- having -- an operating state -- becoming -- a light sensing portion -- ten -- plurality -- light-receiving -- the section -- A -- B -- or -- A -- ' -- B -- ' -- dividing -- having .
[0044]The light-emitting part 31 generates the infrared light IRED again to the following predetermined timing by control of the microcomputer 34. the microcomputer 34 refers to the detecting signal from the amplifier 16 and the detecting signal from the amplifier 14 concerning the section B or B' for the light-receiving result in the light sensing portion 10 to this light -- the section B or B' -- the position of the photo-diode which received light inside is detected.
[0045]Thusbased on the output from the amplifier 12 and 16 of resistance group RR both endsthe light-receiving field in the light sensing portion 10 judges [the light-receiving sections A and B or light-receiving section A'and] first in any of B' it exists. Nextthe amplifier 14 is operatedthe detect output from either one of the amplifier 14 of the both ends of the section or amplifier 12 and 16 judged based on the above-mentioned decision result is judgedand the position of the photo-diode which received light within the section is detected. As mentioned aboveafter specifying the section of a light-receiving fieldin order to detect a light-receiving position within the sectionwhile detecting accuracy improvesit becomes detectable [a light-receiving position] by minimum detection frequencyand it becomes possible to shorten substantially the detection time which a light-receiving detecting position takes.
[0046]In drawing 5multiple-times generating may be carried out based on the position detection accuracy which an IRED generated signal is not restricted 1 time respectivelybut is demandedthe signal generation of IRED may be equalizedalthough the example per time is shown once at the time of ON at the time of OFF of the switch 18and accuracy may be raised more.

[Distance detecting method] Drawing 6 shows the principle of triangular ranging used in order to find the distance to an object. As shown in drawing 6the light from the light-emitting part 31 reaches the photographic subject 40 via the lens 44 for floodlightingit is condensed with the lens 46 for condensingand the light reflected with this photographic subject 40 is irradiated by the prescribed position of the light sensing portion 10.

[0047]If distance from the lens 44 for floodlighting to the photographic subject 40 is set to l (l1l2)the light reflected in the distance l1 will enter into the position which only the distance x1 separated from the reference position in the light-emitting part 10for example. When it is in the position of the distance l2light enters into the position which is [distance x2] distant from a reference position in the light sensing portion 10.

[0048]Hereabout the distance of the optic axis of the lens 44 for floodlightingand the optic axis of the lens 46 for condensingif distance of Dthe lens 46 for condensingand the light sensing portion 10 is set to fthe distance x1 in the light sensing portion 10x2and the distance l1 to the photographic subject 40 and l2 will become a relation like a following formula.

[0049]

[Equation 1]

x1 =Dxf/l1 .... (1)

[Equation 2]

x2 =Dxf/l2 .... (2)

Thereforethe distance l from a camera to the photographic subject 40 is detectable with sufficient accuracy in a short time by detecting the light-receiving position in the light sensing portion 10and calculating an upper type based on the position by the above methods.

[0050]

[Effect of the Invention]Two or more optical detector elements are connected to a resistance grouprespectivelyand the photoelectric current which an optical detector element receives and is generated by this resistance group is made to

shunt in this inventionas explained above. This resistance group can be made in the same substrate as a photo detector using a diffused resistor etc.and that resistance can be set up freely. It becomes easy [also making the ratio of the resistance of each resistance almost the same furthermore].

[0051]thereforethe light-receiving position detecting circuit of this invention forms composition required for a light-receiving detecting position on a one chip -- things can be carried outand wiring distance from a light sensing portion to a current detecting means can be shortenedand circuit partssuch as a current detecting meanscan be shielded easily. for this reasonthe influence of an extraneous noise etc. is lost and it becomes possible to boil position detection accuracy markedly and to raise it.

[0052]Light-receiving position detection accuracy within a light sensing portion can be selectively made high according to a demand by considering division of the light-receiving section of the light sensing portion by the 3rd current detecting means as desired distribution. Thereforefor examplewhen this light-receiving position detecting circuit is applied to a distance sensing deviceit becomes possible to detect a specific distance of even an object with sufficient accuracy selectively.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the composition of the light-receiving position detecting circuit of this embodiment.

[Drawing 2]It is an outline sectional view of the light-receiving position detecting circuit of drawing 1.

[Drawing 3]It is a figure showing the composition of the camera using the light-receiving position detecting circuit of this embodiment.

[Drawing 4]It is a figure showing the method for detecting the light-receiving

position of the light sensing portion 10 of drawing 1.

[Drawing 5]It is a figure showing the drive method of the light-receiving position detecting circuit of this embodiment.

[Drawing 6]It is a figure showing the principle of triangle ranging.

[Drawing 7]It is a figure showing the composition of the distance sensors using the conventional PSD.

[Description of Notations]

10 A light sensing portion and 12 The 1st current detection amplifier and 14 The 3rd current detection amplifierThe 16 2nd current detection amplifierand 20 [Motor Driver and 38 / The motor for lensesand 40 / A photographic subject and 44 / The lens for floodlightingand 46 / Lens for condensing.] A circuit partthe 30 AF section31 light-emitting partsand 32 A memory and 34 A microcomputer and 36